



# Plant Asset Management

Solutions for the Cement Industry



*The Plant Asset Management Company<sup>SM</sup>*

# Results You Can Bank On

PAM

*Plant Asset Management*



Plant Asset Management (PAM) is a structured approach to operating and maintaining your plant's mechanical and electrical equipment that combines condition monitoring, maintenance management, and reliability management tools and methods for optimal business results. When including lost production for the time their assets would otherwise be out of service, cement plants using Bently Nevada's PAM solutions can typically achieve these benefits:

- > Avoidance of a full 40% of maintenance costs
- > A 20% improvement rate in production
- > Internal Rate of Returns that can range from 133% to 256%
- > Payback periods that are generally less than a year
- > Increased revenues
- > Reduced asset life-cycle costs
- > Fewer process interruptions and unplanned outages
- > Lower repair costs
- > Proactive, rather than reactive, maintenance
- > Better real-time operating decisions through better asset information

It's not surprising that more and more cement plants are turning their attention toward improving their asset management practices as one of the most effective ways to positively impact safety, product quality/throughput, machinery reliability/availability – and of course, profits.

## Comprehensive Scope For The Cement Industry

***“Assets can be Technology, Capital, or People – Improved Plant Asset Management Improves them All.”***

With over 25,000 global customers, Bently Nevada has the experience to help you improve your Plant Asset Management program. We design, integrate, implement, and support systems to provide specific customer solutions that help produce the exceptional business results you demand. Our PAM solutions can be tailored to meet the special needs of the cement industry in all process areas. And, they can be applied to virtually every subsystem or production asset in your plant.

Process Areas	Assets	
<ul style="list-style-type: none"> <li>• Quarry</li> <li>• Raw material / meal preparation</li> <li>• Clinker production</li> <li>• Cement production</li> <li>• Dispatch</li> </ul>	<ul style="list-style-type: none"> <li>• Drilling machines</li> <li>• Excavators</li> <li>• Haul trucks</li> <li>• Crushers</li> <li>• Grinding mills</li> <li>• Homogenizing silos</li> <li>• Kiln equipment</li> <li>• Ventilators</li> </ul>	<ul style="list-style-type: none"> <li>• Blowers</li> <li>• Electric Motors</li> <li>• Switchgear</li> <li>• Motor Control Centers</li> <li>• Transformers</li> <li>• Gears</li> <li>• Conveyors</li> </ul>

# The Right Company

Solutions

*People, Processes, and Products*



Bentley Nevada is uniquely qualified to help improve your PAM program because our solutions address every facet of what it takes to make PAM successful. We help you employ the right **products**. We work with you to identify and incorporate the best **processes** into your operating and maintenance practices. And, we offer consulting expertise to help ensure your most important resources – your **people** – understand your PAM strategy and their role in making it maximally effective.

## Why Bentley Nevada?

With nearly half a century of experience, we're the most trusted and widely used provider of systems and services for assuring machinery health. Bentley Nevada products are world-renowned and today are the standard against which all others are measured. The Bentley Nevada name is synonymous with the highest possible quality – delivering solutions that work the first time, are on-time and on-budget, and meet your exact requirements.

Year after year, Bentley Nevada's customers come back to us. *Why?* Because Bentley Nevada delivers the results you need.



## The Right Tools

An effective PAM program relies on more than just a single tool or technology. It uses multiple tools in harmony with one another to address the three fundamental questions inherent in managing assets:

What do I work on and why?

**Tool: Condition Monitoring**

How do I optimally perform the necessary work?

**Tool: Maintenance Management**

What are my macro goals and how am I performing relative to those goals?

**Tool: Reliability Management**



At its heart, PAM is about improving your decision-making process by delivering the right information to the right people at the right time. That's why Bentley Nevada's approach to Plant Asset Management emphasizes each of these tools and helps you use them as an integrated system for improved results. By optimizing your decision-making process, we can help you achieve exceptional business results – regardless of the current state of your PAM program.

# Services

## Breadth

*In addition to our complete range of condition monitoring hardware and software, Bently Nevada has a growing range of services and integrated solutions to help our worldwide customers improve their Plant Asset Management programs.*

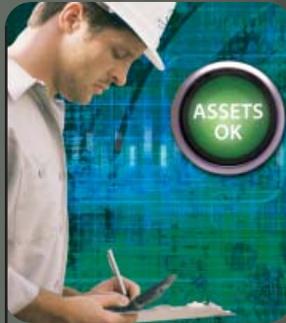


### Opportunity / Risk Assessment

Data-driven evaluation of plant equipment to determine the appropriate condition monitoring and asset management approaches warranted by the asset, and the expected ROI that a recommended approach will deliver. The evaluation encompasses factors such as the asset's criticality to the process, cost to repair, failure history, and safety impact. It also includes consideration of the customer's current maintenance management processes, reliability systems, and business objectives.

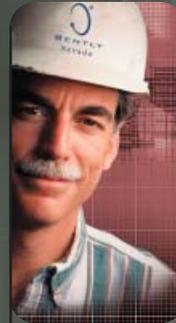


### Product Installation, Packaging, and Project Management



### Results Assurance

We not only install PAM solutions, but work to ensure they continue to operate efficiently and provide value. Through our *Results Assurance* program, a Bently Nevada Asset Management Specialist provides three days per month of evaluation and review of your program and activities to ensure all systems are optimized and your plant is obtaining maximum benefit.



### Outage Planning and Support



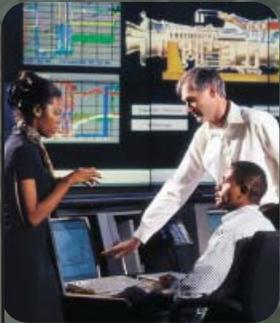
### Product Verification and Repair



### System Integration Services

We have extensive experience integrating our condition monitoring solutions with:

- > process control and automation systems
- > maintenance management systems (CMMS, EAM)
- > reliability management systems
- > additional condition monitoring technologies
- > plant IT infrastructures including local and wide area networks, e-mail and other messaging services, and various desktop applications you may already be using



### Remote and On-site Machinery Diagnostics



### Machinery Balancing and Alignment



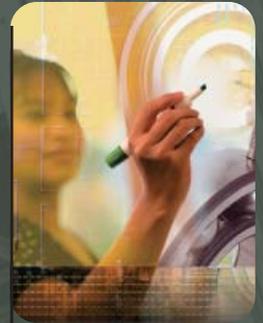
### Condition Monitoring

For those customers who want to outsource some or all of their ongoing asset management activities, we offer a convenient and effective way for you to focus on your business while we focus on the day-to-day activities of managing your assets including running and staffing your entire condition monitoring program. We draw on a wide range of technologies to ensure all identified assets are regularly and completely assessed:

- > vibration
- > lubrication
- > motor current
- > thermography
- > visual inspection
- > ultrasonic / NDT Inspection



### PAM Program Management and Consulting Services



### On-site and Off-site Training

## Technology

*The assets in a cement plant are addressed with a combination of three basic condition monitoring approaches.*



### Continuous, online monitoring

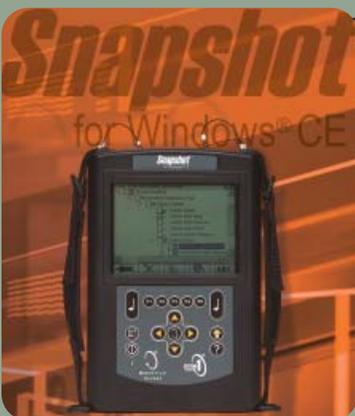
This approach is applied to only the most critical assets in the plant where the cost of asset failure is substantial, where safety concerns are paramount, and/or where problems can only be reliably detected and prevented using continuous monitoring technologies that collect data several times per second. Our 3500 Series Machinery Protection System, coupled with a complete selection of temperature, pressure, speed, vibration, and other transducers, is recommended for all such applications. However, only a very few, if any, assets in a typical cement plant will warrant such a system. It will often be found on the power generation equipment of those plants that generate their own power or steam, and occasionally on critical blowers or fans.



### Distributed, sensor bus monitoring

Our innovative and cost-effective Trendmaster® Pro system is recommended to meet the condition monitoring needs for many of the assets found in a cement plant. It links our System 1™ software to thousands of permanently mounted condition assessment sensors via wired and wireless networks. The Trendmaster platform provides online condition monitoring measurements on general-purpose machinery and mechanical equipment that cannot justify the expense of traditional rack-based continuous monitoring systems, such as 3500. By using a special sensor-bus network and low-cost data acquisition modules called DSMs that can scan thousands of connected sensors, Trendmaster delivers quasi-continuous condition monitoring, typically scanning each point several times per hour. Its architecture lowers the cost-per-monitored-point closer to levels historically associated with condition monitoring programs that rely on manual data collection.

Recommended for the quarry and crushing process, Trendmaster can help monitor the Primary and Secondary crushers, ensuring that the limestone is crushed to the specified size. Trendmaster has also been successfully utilized during pyro processing – the most important process for determining cement quality. It also helps detect kiln ovality and creep when used on the major rotating machinery in the kiln process.



### Manual data collection systems

This approach is applied to those assets that can benefit from periodic condition monitoring but cannot justify the expense of an online system. It consists of a portable data collection instrument and personnel trained to collect and analyze various data taken from the asset. Data collection intervals using such systems generally range from a few weeks to a few months. Bently Nevada's Snapshot™ for Windows® CE portable data collector is specifically designed to meet the needs of a variety of assets for both manual data collection and at-machine diagnostics and analysis. It supports vibration, manual note entries, infrared, and other condition monitoring technologies. Pre-configured routes are loaded into the data collector, and data is collected by physically walking to each asset and making the required measurements using permanent or portable sensors. The collected data is then downloaded to our System 1 software where it can be used just as data collected by our continuous and scanning systems.

# System 1™

Intelligence

*Software that actually analyzes the data for you.*



At the heart of our condition monitoring solutions is System 1™ software. It brings together our portable data collector, Trendmaster® Pro hardware, and 3500 Machinery Protection Systems as sources of data into a single, unified condition monitoring platform. This remarkable tool supports every asset and condition monitoring technology in your plant. Whether a kiln or a pump, crusher or heat exchanger, control valve or storage tank, System 1 can handle it. The system integrates vibration, thermography, infrared, visual inspection, oil analysis, ultrasonic NDT, and virtually any other technology out there – whether online or offline. And, data sources can include non-Bentley Nevada hardware with support for numerous process control and automation platforms, spreadsheets and databases – even manually entered data such as notes or clipboard readings.

But System 1 goes further than just collecting, trending, displaying, and storing data. Using our patented Decision Support™ technology, System 1 actually analyzes the data it collects using embedded knowledge as well as pre-configured and user-written rules. The results of System 1's analysis are called Actionable Information® advisories – plain-language messages delivered to you via e-mail, cell phone, pager, desktop notifier client – even integration with your plant's control system screens or maintenance management and reliability management systems. These intelligent advisories can be easily acted upon by operations and maintenance people alike, and can be totally customized to your plant's operating practices, asset designators, and other details – right down to the names of people to call and their phone numbers when a problem occurs.

## RuleDesk™ – You Write the Rules

System 1's Decision Support capabilities are remarkably powerful because you can easily customize its embedded rules with our RuleDesk™ features. RuleDesk lets you take any condition that can be modeled using standard flowchart nomenclature and easily enter it into System 1's database. Whether it is something as simple as mapping bearing fault frequencies to a particular bearing component and automatically triggering a work order when a failing bearing is detected, or something as sophisticated as recognizing the process conditions that affect kiln ovality and alignment, RuleDesk can handle it – without complicated programming or special training required.





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